Physics 339, Optics
Spring 2021, 9-9:50am MWF

Due to the covid-19 pandemic, classes will be conducted via Zoom meetings and/or video lectures linked on Canvas:

https://wwu-edu.zoom.us/j/93340447824

(Meeting ID: 933 4044 7824)

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Course goals, objectives, and outcomes: The main *goal* of the Optics course is for you to increase your understanding of the physical and geometrical optics that is behind the myriad optical devices in today's world. Examples of such devices include microscopes, telescopes, cameras, the human eye, computer and phone display screens, laser pointers, interferometers, fiber optic cables, and the many sophisticated optics-based instruments in modern research laboratories.

Specific *objectives* for the course are to gain a working knowledge of the basic properties of light such as intensity, polarization and its wave/particle nature, and phenomena such as refraction, reflection, absorption, diffraction and interference of light.

The desired *outcomes* of the course include: (i) improved conceptual understanding of the Physics and Mathematics associated with Optics (ii) a theoretical understanding of how basic components in optical devices work, (iii) improved ability to solve quantitative problems, both independently and in groups.

Reference Materials: The required text for the course is *Optics* by Eugene Hecht (5^{th} ed., although 4^{th} is fine as well.). The course website contains useful links including the course syllabus, weekly assignment listings, and assignment and test solutions. We will occasionally make use of *Mathematica* symbolic algebra software in class and in assignments. Please familiarize yourself with this software if you have not already used it in previous courses.

Approximate Schedule: Chapter sections in red are reading assignments (These may not be explicitly covered in lectures, but they are still examinable. Typically, they have been/will be covered in other courses.). Chapter sections in blue contain mathematical derivations that lead to important results (e.g. the Fresnel equations). You are responsible for knowing about these results but not all the details of the derivations. (Details will be covered in other courses.)

Required background: Physics 163 and 368 are pre-requisites. I will assume that you are comfortable with the mathematics used throughout the Physics curriculum including vector algebra, partial differential equations, and complex numbers.

The schedule below will be continually revised as the quarter progresses. Check back regularly.

Schedule as of March 31, 2021

Wk	Dates	Hecht (4^{th} and 5^{th} editions)	339 Lecture Topic
1	Mar 31-Apr 2	2.1-2.3,2.4, 7.2.1, 7.2.2,	Wave motion (propagation)
2	Apr 5-9	2.5, 2.6, 2.7-2.9, 2.10	Waves in 3-D: plane, spherical and cylindrical
3	Apr 12-16	3.1, 3.2-3.3.2, 3.3.3,	Maxwell's equations, EM waves, Poynting vector, irradiance, photons
4	TEST 1, Monday April 19^{th}		
4	Apr 19-23	3.3.4, 3.4-3.7	radiation pressure and momentum
5	Apr 26-30	4.1-4.2, 4.3-4.4,	Rayleigh scattering, light in dense media, origin of dispersion,
6	May 3-7	4.4-4.5, 4.6.1-4.6.2, 4.6.3	Reflection, refraction, Fresnel equations geometrical optics (basic definitions needed for lab), Fresnel equations, amplitude ratios, phase shifts on reflection
7	TEST 2, Monday May 10^{th}		
7	May 10-14	4.6.3, 4.7, 5.1, 5.2.1-5.2.2, 5.2.3, 5.3.3	Reflectance, transmittance, total internal reflection, basic assumptions of Geometrical optics, refraction at spherical surfaces, thin lens equation (Gaussian and Newtonian form), focal points and planes, magnification, lenses in combination, f-number
8	May 17-21	5.4.1-5.4.2, 5.4.3, 5.5.1, 5.6, 5.7.1-5.7.3, 5.7.5-5.7.7	Mirrors (planar, aspherical, spherical), Optical systems (human eye, eyeglasses, magnifying glasses, telescopes)
9			
9	May 24-28	6.1, 6.2, 6.2.1 6.3.1-6.3.2, 8.1-8.8, 8.13.2, 9.1-9.5	Thick lenses, analytical ray tracing, matrix methods, Polarization(linear, circular, elliptical), polarizers, dichroism, birefringence, scattering, wave plates, circular polarizers. Jones vectors, Interference
10	June 2-4 (Monday is a Holiday	12.1-12.4, 9.6-9.7, 10.1-10.4	Coherence Multiple beam interference, Diffraction
	Exam week		**339 Exam: Wed, June 9, 10:30-12:30**

Homework: There will be a weekly assignment which is to be completed before our class on Mondays. Most of the assignment questions will be taken from Hecht and hence brief solutions may be found in the back of the text. More complete solutions will also be provided via Canvas. I strongly suggest that you make a serious effort at doing the problems *before looking at the solutions*! In any case, make sure you know how to do the problems quickly and completely without reference to the solutions.

The assignments will not be handed in or graded. However be forewarned: quiz, test, and final exam questions may closely resemble assignment problems. You will not do well in quizzes and tests unless you are fully comfortable with the assignment material. Make sure to contact me if you

do not understand the solutions to any of the problems.

Tests: There will be two mid-term tests, and a final two-hour cumulative exam. You may use any notes you have made during the quarter, a calculator, and the course's textbook (*Hecht*). However, consultation with fellow students, Chegg, or other repositories of assignment/test solutions is not allowed. The tests will be administered on Canvas.

Quizzes: There will be roughly 8 short (10 minute) quizzes given generally on Mondays (but other days possible as well!). These will be closely related to the previous few days' lectures and/or assignments. The quizzes will be done using Canvas or email and will have a time allotment of 10 minutes.

Grades:

Quizzes	2 midterm tests	final exam
15%	25% each	35%

WWU Spring 2021 Grading Policy:

Students may designate a course as Pass/No Pass by submitting the Grade Mode Change Form with the Registrar's Office after registering for the course; they may change this designation by submitting the change to the Registrar's Office at any time through June 3, 2021. After that date and through June 15, 2021, in case of hardship, a student may request a late change to Pass/No Pass grading by contacting their instructor.

Full details are at: https://registrar.wwu.edu/spring-2021-undergraduate-grading-policy

In this course, a grade of C- or higher will be required to earn a grade of Pass (P). D+ and lower will be recorded as a No Pass (NP). Students earn their letter grade in this course by achieving overall course scores of:

LETTER GRADE SCALE

Percentage	90-100	85-89	80-84	77-79	73-76	70-72	67-69	63-66	60-62	57-59	53-56	<53
Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

Covid-19, Accomodations, and General WWU policies

The covid-19 pandemic is taking a toll on all of us. Please let me know if you have circumstances that require accommodations and I will do my best to help. If you have ideas on how to make the course run more smoothly please feel free to offer suggestions!

Please read the document https://syllabi.wwu.edu/ for information on covid-19 related accommodations as well as complete information on general WWU topics such as Academic Honesty, Accommodations, Ethical Computing Resources Conduct, Equal Opportunity, Finals, and the Student Conduct Code.